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Phosphorene: A New High-Mobility 2D Semiconductor HAN LIU, ADAM NEAL, Purdue University, ZHEN ZHU, DAVID TOMANEK, Michigan State University, PEIDE YE, Purdue University — The rise of 2D crystals has opened various possibilities for future electrical and optical applications. MoS_2 n-type transistors are showing great potential in ultra-scaled and low-power electronics. Here, we introduce phosphorene, a name we coined for 2D few-layer black phosphorus, a new 2D material with layered structure. We perform *ab initio* band structure calculations and show that the fundamental band gap depends sensitively on the number of layers. We observe transport behavior, which shows a mobility variation in the 2D plane. High on-current of 194 mA/mm, high hole mobility up to 286 $cm^2/V{\cdot}s$ and on/off ratio up to 10^4 was achieved with phosphorene transistors at room temperature. Schottky barrier height at the metal/phosphorene interface was also measured as a function of temperature. We demonstrate a CMOS inverter with combination to MoS_2 NMOS transistors, which shows great potential for semiconducting 2D crystals in future electronic, optoelectronic and flexible electronic devices.

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